Low Thrust Trajectory Optimization in Cislunar and Translunar Space

Completed Technology Project (2015 - 2018)

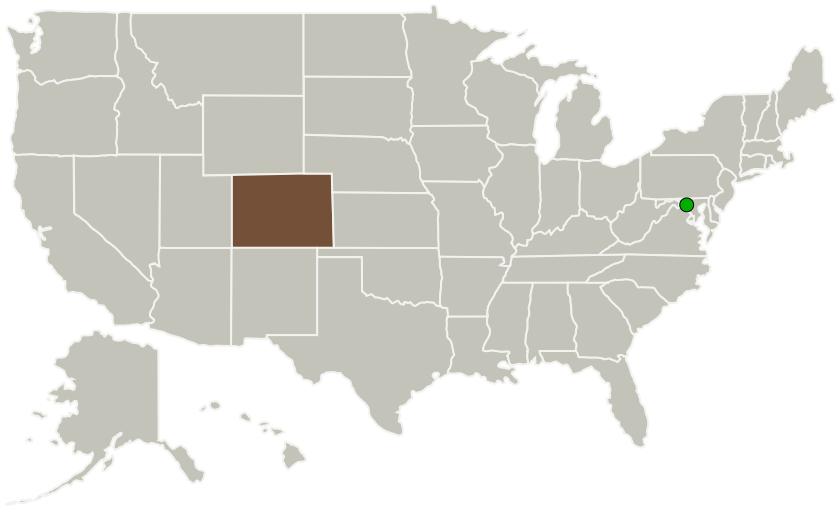
Project Introduction

The goal of this project is to advance the state of the art with regard to low thrust trajectory optimization in 3-body and 4-body force models, specifically in Earth-Moon space. The proposed research will bring together two areas of space exploration capability that have each brought new kinds of missions to the table: electric propulsion (equivalently referred to as "low thrust propulsion" or "solar electric propulsion") and low-energy transfers. These two areas of study have mostly existed in isolation from each other. The proposed research will explore how bringing them together can be an enabling space technology, and it will quantify the resulting mission benefits and risks. This research will be conducted at the University of Colorado using high fidelity numerical simulations, using code developed specifically for this research and also code that has been developed in the research center to address many similar problems. The trajectory solutions will be validated with NASA software. Some of the questions that will be addressed include: What existing optimization methods for low-thrust trajectories are most suitable for onboard computation? What new missions can be enabled with active thrusting to transfer between halo orbits? Some of the perceived benefits are: reduced mission design time; reduced time of flight, traded with fuel cost; and new types of missions enabled.

Anticipated Benefits

The goal of this project is to advance the state of the art with regard to low thrust trajectory optimization in 3-body and 4-body force models, specifically in Earth-Moon space.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
University of Colorado Boulder	Lead Organization	Academia	Boulder, Colorado
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations
Colorado

Project Website:

https://www.nasa.gov/strg#.VQb6T0jJzyE

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

University of Colorado Boulder

Responsible Program:

Space Technology Research Grants

Project Management

Program Director:

Claudia M Meyer

Program Manager:

Hung D Nguyen

Principal Investigator:

Daniel Scheeres

Co-Investigator:

Nathan P Re

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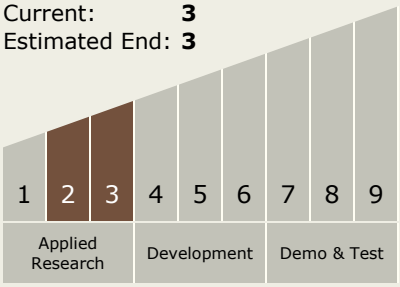
Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX17 Guidance, Navigation, and Control (GN&C)
  - TX17.2 Navigation Technologies
    - TX17.2.6 Rendezvous, Proximity Operations, and Capture Trajectory Design and Orbit Determination

Target Destination

Earth